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(56) Documents Cited
GB 2283384 A GB 2229885 A GB 2215551 A
GB 2191904 A GB 2157529 A GB 2129160 A
GB 0651068 A GB 0572518 A GB 0319659 A
US 4588298 A US 4183990 A
Kodak Graphic Arts Handbook published 1975 Leaflet GA-Clr-11 p3

(58) Field of Search
UK CL (Edition N) G2X X35 , H4F FCD FGC
INT CL[6] G03C , H04N 3/36 3/38 3/40

(54) Determining correct exposure of film for telecines

(57) When transferring negative film to video tape, the colourist, the operator of a telecine, needs to adjust the settings of the telecine, in particular, gamma, lift and gain, so that the transfer of the film is optimised. A method of creating a photographic element to assist in such transfer of film, which element includes a grey scale portion which allows a scene to be readily graded, is disclosed. The method also includes providing exposure information for cinematographers/directors of photography relating to the scenes being transferred.

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

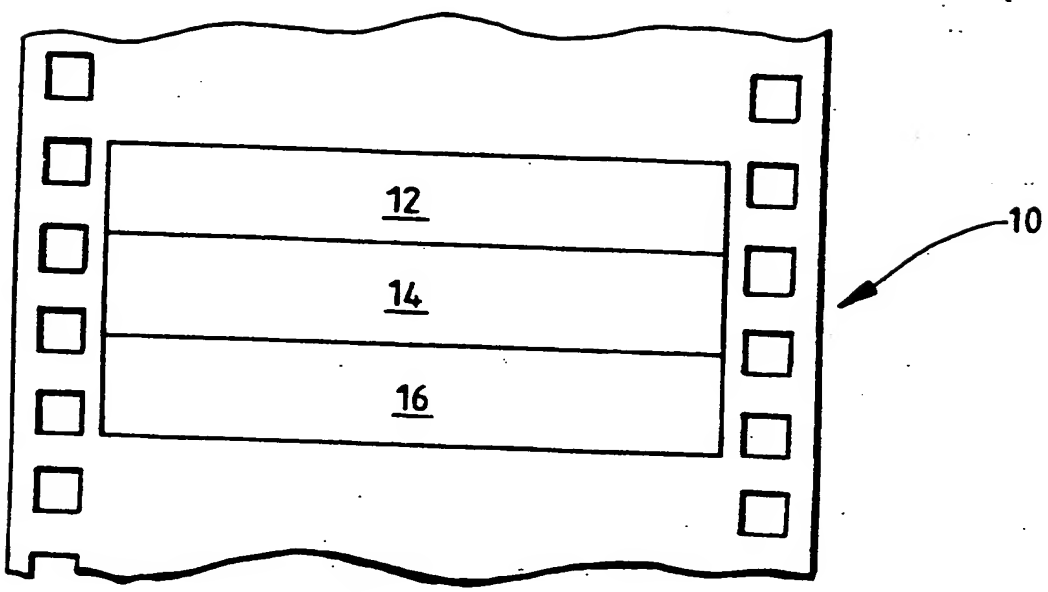
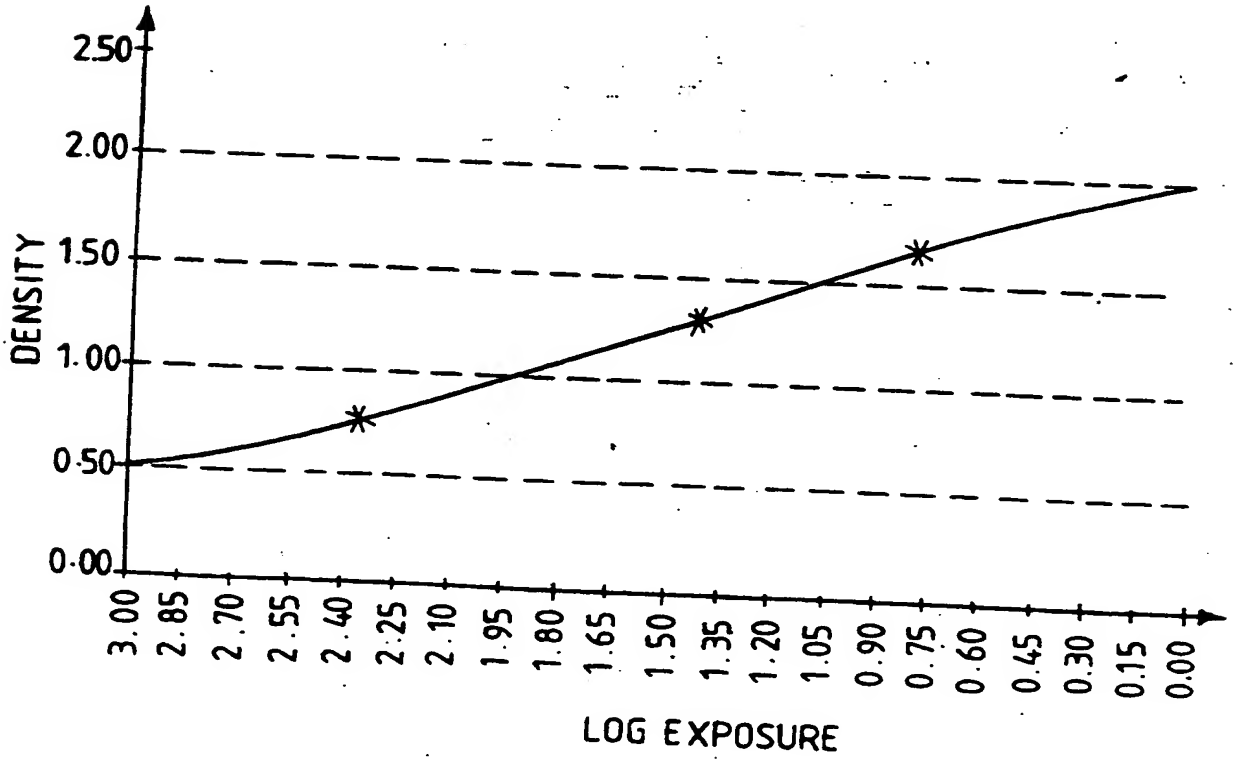

12
14
16
10

Fig.1.


2.50
2.00
1.50
1.00
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DENSITY
3.00
2.85
2.70
2.55
2.40
2.25
2.10
1.95
1.80
1.65
1.50
1.35
1.20
1.05
0.90
0.75
0.60
0.45
0.30
0.15
0.00
LOG EXPOSURE

Fig.2.

IMPROVEMENTS RELATING TO TELECINES

Field of the Invention

The present invention relates to improvements relating to telecines, and is more particularly concerned with the control of the telecine transfer of motion picture film to video tape.

Background of the Invention

It is well known that film dailies or rushes are conventionally produced as a motion picture is shot. These dailies or rushes are processed and then viewed by the director, the producer, the film editor etc working on the production to determine whether the scenes shot are acceptable - each person on the production team assessing the dailies for different elements relevant to their respective roles in the team.

'Printer Light' information is also provided which assists the cinematographer/director of photography to determine whether the scenes were shot with a satisfactory exposure. This 'Printer Light' information is determined from the settings of a conventional printer. This information is obtained by passing white light from a scene through dichroic filters to split the light into its three components, red, green and blue. The three light components are then used to expose a test film strip from which the densities corresponding to the intensities of the red, green and blue components of the light can be measured and compared with standard densities which correspond to an 'ideal' exposure. The densities produced by the red, green and blue light components on the test film strip give an indication of the exposure given to the original film as the scene was recorded. 'Printer Light' information provides values between 0 and 50,

the neutral values being 25, 25, 25 and correspond to the 'ideal' exposure. 'Printer Light' values greater than or less than the neutral values correspond to over- or under-exposed respectively.

However, there is an increasing demand for motion picture negative film to be transferred to video tape, and the film is never printed as such, as most film programmes made specifically for television, for example, episodic shows, movies of the week and commercials, are transferred to video tape prior to showing. Telecine machines enable this transfer to be achieved.

Furthermore, in feature film production, video dailies are replacing the film dailies or rushes and non-linear editing techniques are replacing conventional film editing.

Problem to be solved by the Invention

When transferring negative film to video tape, the colourist, operator of a telecine, needs to adjust the settings of the telecine, in particular, gamma (or contrast), lift (or detail in the black areas of the scene) and gain (or brightness), so that the transfer of the film is optimised. This may be time-consuming if the film has not been correctly exposed, the colour balance is incorrect etc, and adjustments have to be made.

Moreover, with video dailies replacing film dailies, directors of photography for a production need to be provided with information relating to the camera exposure in a similar way to previously used printer light information.

Summary of the Invention

It is therefore an object of the present invention to provide a method of grading a scene as it is transferred from negative film to video tape, and

in particular to provide exposure information similar to 'Printer Light' information.

It is a further object of the present invention to provide a reference which can be used to transfer any negative film to video tape which saves time during the transfer.

In accordance with one aspect of the present invention, there is provided a photographic element comprising at least one grey scale portion, characterized in that each grey scale portion is formed from a target comprising a black, a grey and a white region.

Preferably, the black region is a 3% reflectance, the grey region is an 18% reflectance and the white region is a 90% reflectance.

Advantageously, the grey scale portion fills a full frame on the element.

In a preferred embodiment of the photographic element, the grey scale portion is horizontally arranged thereon.

In accordance with a second aspect of the present invention, there is provided a method of transferring a scene recorded on negative film to video tape using a telecine, the method comprising the steps of:-

a) setting up the telecine so that predetermined waveform readings are obtained for a photographic element as described above;

b) storing the telecine set-up settings;

c) loading a scene on negative film into the telecine; and

d) using the stored telecine settings to effect transfer of the scene to video tape.

It is preferred that the scene includes a 'grey card' corresponding to at least one region of

the grey scale portion of the photographic element. In this case, the method further includes the step of determining red, green and blue video voltages for the 'grey card', the red, green and blue video voltages providing exposure information for the scene.

The red, green and blue video voltages may be converted to 'Transfer Points'.

Alternatively, if no 'grey card' is present in the scene, the method further comprises the step of grading the scene and determining the green video voltage corresponding to the grey region of the element, the green video voltage providing exposure information for the scene.

The green video voltage may be converted to an exposure level.

In accordance with a third aspect of the present invention, there is provided apparatus for providing exposure information during the transfer of a scene, including a grey card, recorded on negative film to video tape using a telecine, the apparatus comprising:-

a photographic element as described above, the element being used for setting up the telecine so that predetermined waveform readings are obtained for the grey scale portion of the photographic element;

conversion means for determining red, green and blue video voltages for the 'grey card' and for converting these voltages to 'Transfer Points'; and

display means for displaying the 'Transfer Points' for the scene.

Advantageous Effect of the Invention

In accordance with the present invention, a reporting system similar to 'Printer Light' type information can be provided which facilitates

communication between colourists and cinematographers/directors of photography.

Moreover, an aid to correct exposure is provided so that it is possible to predict the outcome of light settings on a release print or on a video transfer.

Furthermore, the telecine set-up procedure for transfer of a negative film to video tape is much simplified providing a reliable starting point for the transfer of substantially all negative film stocks.

Brief Description of the Drawings

For a better understanding of the present invention, reference will now be made, by way of example only, to the accompanying drawings in which:-

Figure 1 illustrates a photographic element in accordance with the present invention; and

Figure 2 shows a green sensitometric curve showing the three points which are incorporated into the photographic element of Figure 1.

Detailed Description of the Invention

It has been determined that the tone scale of processed colour negative film may be defined by three sets of red, green and blue density values when transferring the film to video tape using a telecine. By defining the waveform monitor readings for the red, green and blue voltages which correspond to the three densities, each telecine machine can be aligned to a common standard for the transfer of colour negative films.

The most important density value is that corresponding to the correct exposure of a standard 18% 'grey card' which is commonly used by cinematographers/directors of photography in their lighting set-up. Two other density values which correspond to 90% reflectance and 3% reflectance,

together with the 18% reflectance, mirror the straight line portion of the film characteristic within the telecine. These values allow maximum advantage to be taken of the latitude available within film stocks.

It will be appreciated that specular reflections and deep blacks lie outside the range of reflectances described above, but these can be explored by a colourist or operator of the telecine using the full range available in the telecine machine.

In accordance with the present invention, Figure 1 shows a photographic element 10 which comprises length of film strip having three patches 12, 14, 16 formed thereon. The element 10 is a 35mm motion picture negative film strip, Eastman EXR 200T negative film *ex* Eastman Kodak Company. Patches 12, 14, 16 are arranged on the element 10 so that they fill a complete frame, that is, the patches together have overall dimensions of approximately 22mm by 16mm, each patch having a width of approximately 5mm. Each patch 12, 14, 16 comprises a horizontal grey scale formed by shooting a target having patches of a 3% reflectance, an 18% reflectance and a 90% reflectance respectively. As mentioned above, the grey scale values are chosen to mirror the straight line portion of the green sensitometric curve which is characteristic of normally exposed Eastman EXR film stocks as shown in Figure 2.

The densities for each of the patches 12, 14, 16 in relation to red, green and blue are shown in Table 1.

Table 1.

PATCH	RED	GREEN	BLUE
WHITE	1.17	1.69	2.08
GREY	0.83	1.28	1.64
BLACK	0.41	0.74	1.05

Although Table 1 gives a set of values for red, green and blue densities for each patch, it will be readily appreciated that other density values may be utilised in accordance with the reflectances chosen for a particular target from which the element is made.

Similar elements (not shown) can also be produced for Super 16mm motion picture negative film stocks.

Each element 10 is produced by shooting the grey scales thereon using the parameters given in Table 2. Examples are given for 35mm and 16mm film stock.

Table 2.

	35mm film stock	S16mm film stock
Camera	Aaton 35/1	Aaton XTR
Lens	Zeiss 135mm	Zeiss 135mm
Lens aperture	T4	T4
Lights	2 x 2 K Quartz 8.7 eV on grey	2 x 2 K Quartz 8.7 eV on grey
Target distance	2.1m	2.8m

Naturally, although the photographic element 10 of Figure 1 only shows one grey scale arrangement having patches 12, 14, 16, it will be readily appreciated that any number of such arrangements can

be provided on the element 10 for ease of access by the colourist.

In order to set up a telecine in accordance with the photographic element 10, it is loaded into the telecine in the normal way. Using only the primary controls of lift (detail in black areas), gain (brightness) and gamma (contrast), and the primary colour correction system, the controls are adjusted to achieve waveform monitor readings so that the three patches 12, 14, 16 give equal red, green and blue values at the waveform monitor. Minor colour correction adjustments may also be necessary to fine-tune the setting. The settings are then stored in the telecine for recall at any time. The element 10 can then be removed from the telecine and stored in a suitable way to prevent it fading.

The element of the present invention can be used to provide a starting point for grading of a scene. This saves time and adds consistency to the results of a telecine transfer.

The telecine is first set up using the element 10 as described above. The negative film is then loaded in the telecine and advanced to the first scene. Stored settings are recalled from memory and provided the exposure and processing of the negative have been correctly carried out, the colour negative will transfer satisfactory at this setting, after some minor corrections have been made for colour balance. This has been found to be the case in the majority of instances.

However, if special, mixed or incorrect lighting has been used during exposure, further correction will be necessary. If the exposure is slightly adrift, small corrections in lift may be necessary.

Once this grading has been carried out using the settings of the photographic element 10 in accordance with the present invention, individual scene optimisation can be carried out.

The element 10 is used to calibrate telecines in a similar manner to that in which reference density patches are used to calibrate densitometers. The red, green and blue video voltages associated with the three density patches 12, 14, 16 are given in Table 3.

Table 3.

PATCH	VOLTAGE, V
BLACK	0.03
GREY	0.25
WHITE	0.50

In this way, two telecines can be set up using the element 10 and transfer identical densities into identical red, green and blue video signals.

Experiments to verify this were carried out using four different telecine machines made by Rank Cintel Limited, each machine being located in a different country, that is, in Belgium, France, United Kingdom and the United States of America. These machines were designated as W, X, Y and Z in accordance with Table 4.

Table 4.

DESIGNATION	TELECINE MACHINE	COUNTRY
W	Ursa	Belgium
X	Mark IIIC	France
Y	Ursa Gold	United Kingdom
Z	Ursa Gold	USA

Each telecine machine was set up using the element 10 of the present invention, and the red, green and blue video voltages were measured for a twenty-one step sensitometric strip of Eastman EXR negative film stocks as given below:-

a) Eastman EXR 50D 5245
b) Eastman EXR 100T 5248
c) Eastman EXR 200T 5287
d) Eastman EXR 200T 5293
e) Eastman EXR 500T 5296
f) Eastman EXR 500T 5298

The red video voltages for the twenty-one steps of film stock e) measured on the four different telecine machines set up in accordance with the present invention are shown in Table 5.

Tabl 5.

STEP	RED DENSITY	W	X	Y	Z
21	0.14	0.00	0.00	0.00	0.00
20	0.14	0.00	0.00	0.00	0.00
19	0.15	0.00	0.00	0.00	0.00
18	0.17	0.00	0.00	0.00	0.00
17	0.22	0.00	0.00	0.00	0.00
16	0.31	0.00	0.01	0.00	0.00
15	0.42	0.04	0.04	0.03	0.04
14	0.52	0.10	0.08	0.09	0.08
13	0.61	0.15	0.12	0.13	0.14
12	0.71	0.20	0.17	0.18	0.18
11	0.81	0.27	0.24	0.26	0.26
10	0.92	0.35	0.32	0.33	0.33
9	1.03	0.42	0.42	0.44	0.43
8	1.13	0.50	0.50	0.54	0.52
7	1.22	0.57	0.60	0.65	0.60
6	1.30	0.65	0.67		0.66
5	1.37	-	-	-	-
4	1.42	-	-	-	-
3	1.48	-	-	-	-
2	1.52	-	-	-	-
1	1.55	-	-	-	

By measuring the red, green and blue video voltages of sensitometric strips, it was possible to derive a series of tables which establish a relationship between video voltages and the densities (one table being derived for each telecine and each negative film stock). The densities were then converted into 'Transfer Points' by dividing by 0.025 and off-setting the obtained values to arbitrarily obtain twenty-five 'Transfer Points' for the

laboratory aim density values. This was carried out to make 'Transfer Points' similar to 'Printer Lights' previously utilised when the negative film is printed.

For each of the film stocks mentioned above, it was possible to derive a table for each of the telecines. However, as the results for the 'Transfer Points' were very close, a single table of averaged results was then obtained for each film stock.

It was found that averaging the results for the different film stocks to provide a single final table yielded a small accuracy loss which was within acceptable limits, that is, within ±2 'Transfer Points'. The table of 'Transfer Points' determined this way is given in Table 6.

Table 6.

	RED		GREEN		BLUE	
Exposure (Stop)	Voltage (V)	Transfer Point	Voltage (V)	Transfer Point	Voltage (V)	Transfer Point
	0.00	3	0.05	3	0.05	3
-3	0.02	4	0.07	4	0.06	4
	0.03	5	0.08	5	0.07	5
	0.03	6	0.08	6	0.08	6
	0.04	7	0.09	7	0.09	7
-2.5	0.05	8	0.10	8	0.10	8
	0.06	9	0.11	9	0.11	9
	0.07	10	0.12	10	0.12	10
-2	0.08	11	0.13	11	0.13	11
	0.09	12	0.14	12	0.14	12
	0.11	13	0.15	13	0.15	13
-1.5	0.12	14	0.17	14	0.16	14
	0.13	15	0.18	15	0.17	15
	0.15	16	0.19	16	0.18	16
	0.16	17	0.20	17	0.20	17
-1	0.18	18	0.22	18	0.21	18
	0.19	19	0.23	19	0.22	19
	0.21	20	0.25	20	0.23	20
-0.5	0.22	21	0.26	21	0.25	21
	0.24	22	0.27	22	0.26	22
	0.26	23	0.29	23	0.27	23
	0.28	24	0.31	24	0.29	24
N	0.29	25	0.32	25	0.30	25
	0.31	26	0.34	26	0.32	26
	0.33	27	0.35	27	0.33	27
+0.5	0.35	28	0.37	28	0.35	28
	0.37	29	0.39	29	0.36	29
	0.39	30	0.41	30	0.38	30
	0.41	31	0.42	31	0.40	31
+1	0.43	32	0.44	32	0.42	32
	0.45	33	0.46	33	0.44	33
	0.47	34	0.48	34	0.45	34
+1.5	0.50	35	0.50	35	0.47	35
	0.52	36	0.52	36	0.49	36
	0.54	37	0.54	37	0.51	37
+2	0.57	38	0.57	38	0.53	38
	0.59	39	0.59	39	0.56	39
	0.62	40	0.61	40	0.58	40
+2.5	0.65	41	0.64	41	0.60	41
	0.67	42	0.66	42	0.62	42
	0.70	43	0.68	43	0.65	43
+3	0.71	44	0.71	44	0.67	44

For any two telecine machines which have been set up using the photographic element of the present invention, the 'Transfer Points' will be the same. This is in contrast to 'Printer Lights' which tend to be laboratory specific.

Having determined the 'Transfer Points' conversion table, Table 6 above, it can be used in two ways:-

i) directly if an 18% grey card has been shot at the beginning of a scene, or

ii) to derive an 'Exposure Level' table.

In case i) above, the 18% 'grey card' must be included at the beginning of the scene. The negative film is loaded into the telecine and advanced to locate the 'grey card' for the first scene. The 'grey card' will normally be included at the head of each roll or at the head of each new lighting set-up or at any suitable predetermined intervals. The settings in accordance with the element 10 are recalled from memory, and without changing any controls, the red, green and blue video voltages corresponding to the 18% 'grey card' in the scene are read off. These video voltages can than be converted directly using Table 6 into 'Transfer Points' and the information fed back to the cinematographer/director of photography. In this way, the cinematographer/director of photography can assess the exposure of the film in much the same way as with 'Printer Light' information.

The colourist can then transfer the negative film as required. For example, high contrast and bright images can be transferred for ease of editing.

It is envisaged that apparatus can be provided which automatically determines the 'Transfer

Points' from the waveform monitor as described above when a 'grey card' is included in the scene.

If a 'grey card' is not used at the beginning of the scene, case ii), because it has been forgotten or placed in the scene where a satisfactory reading cannot be obtained, Table 7, derived from Table 6, can be used to enable the colourist to provide exposure level information for the cinematographer/director of photography.

Table 7.

Exposure (Stop)	Green Video Voltage (V)
	0.45
-1.5	
	0.40
-1	
	0.35
-0.5	
	0.30
N	
	0.25
+0.5	
	0.20
+1	
	0.15
+1.5	
	0.10

In order to use Table 7, the colourist must first colour grade the scene by eye using stored settings from the element 10 as a starting point (as previously described). The settings are recorded.

The negative film is then unloaded from the telecine and the photographic element of the present invention loaded into the telecine. The settings applied to the scene are then applied to the photographic element, and the green video voltage of the 18% grey patch is measured. Table 7 is then used to determine the exposure level.

It will be appreciated that the method using Table 7, case ii), is not as accurate as the method using Table 6, case i), as there is a limited exposure level from -1.5 to +1.5. This limitation is the result of the higher subjectivity involved, that is, the settings being obtained according to what a particular colourist likes. This means that images which have been too heavily over- or under-exposed will be corrected in different ways by different colourists.

Although the method described for case ii) is less accurate than case i) as described above, the exposure level information can still be useful to reassure cinematographers/directors of photography about their exposure conditions and can act to warn them that corrections need to be made to the lighting conditions.

It is also possible to include a photographic element in accordance with the present invention on the leader attached to the negative film. This has the advantage that there is no need to reload the element when deriving the 'Printer Light' information when no 'grey card' is present in the scene.

The photographic element of the present invention will enable a telecine machine to satisfactorily transfer the vast majority of Eastman EXR negative film stocks. A proper tone scale

reproduction is ensured and the outstandingly good colour to neutral balance of these film stocks means that even colour correction is quite small.

An additional benefit of the photographic element in accordance with the present invention is that the three horizontal density patches can be used to check for telecine shading problems. However, it will be appreciated that the density patches may also be vertically arranged on the photographic element.

CLAIMS:

1. A photographic element comprising at least one grey scale portion, characterized in that each grey scale portion is formed from a target comprising a black, a grey and a white region.

2. An element according to claim 1, wherein the black region is a 3% reflectance, the grey region is an 18% reflectance and the white region is a 90% reflectance.

3. An element according to claim 1 or 2, wherein the grey scale portion fills a full frame on the element.

4. An element according to any one of the preceding claims, wherein each grey scale portion is horizontally arranged on the element.

5. A method of transferring a scene recorded on negative film to video tape using a telecine, the method comprising the steps of:-

a) setting up the telecine so that predetermined waveform readings are obtained for a photographic element according to any one of claims 1 to 4;

b) storing the telecine set-up settings;

c) loading a scene on negative film into the telecine; and

d) using the stored telecine settings to effect transfer of the scene to video tape.

6. A method according to claim 5, wherein the scene includes a 'grey card' corresponding to at least one region of the grey scale portion of the photographic element, the method further including the step of determining red, green and blue video voltages for the 'grey card', the red, green and blue video voltages providing exposure information for the scene.

7. A method according to claim 6, wherein the red, green and blue video voltages are converted to 'Transfer Points'.

8. A method according to claim 5, further comprising the step of grading the scene and determining the green video voltage corresponding to the grey region of the element, the green video voltage providing exposure information for the scene.

9. A method according to claim 8, wherein the green video voltage is converted to an exposure level.

10. Apparatus for providing exposure information during the transfer of a scene, including a grey card, recorded on negative film to video tape using a telecine, the apparatus comprising:-

a photographic element according to any one of claims 1 to 4, the element being used for setting up the telecine so that predetermined waveform readings are obtained for the grey scale portion of the photographic element;

conversion means for determining red, green and blue video voltages for the 'grey card' and for converting these voltages to 'Transfer Points'; and

display means for displaying the 'Transfer Points' for the scene.

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Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

Application number
GB 9518215.0

Relevant Technical Fields

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(ii) Int Cl (Ed.6) G03C

Search Examiner
MR M K B REYNOLDS

Date of completion of Search
10 OCTOBER 1995

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii)

Documents considered relevant following a search in respect of Claims :-
1-4

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2129160 A	(BRITISH AEROSPACE) whole document	1 at least
X	GB 651068	(KODAK) Figure 1	1 at least
X	GB 572518	(KODAK) Figures 1-3	1 at least
X	GB 319659	(ELECTRICAL RESEARCH) Figure	1 at least
X	US 4588298	(FUJI) Figures	1 at least
X	US 4183990	(FUJI) Figures 4-5	1 at least
X	Kodak Graphic Arts Handbook published 1975 leaflet GA-Ur-11 page 3		1 at least

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).

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Patents Act 1977
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(i) UK Cl (Ed.N) H4F FCD, FGC

(ii) Int Cl (Ed.6) H04N 3/36, 3/38, 3/40

Search Examiner
MR J P COULES

Date of completion of Search
9 NOVEMBER 1995

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii)

Documents considered relevant following a search in respect of Claims :-
5-10

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A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2283384 A	(PANDORA) see whole document	5 at least
X	GB 2229885 A	(RANK CINTEL) see whole document	5 at least
X	GB 2215551 A	(RANK CINTEL) see whole document	5 at least
X	GB 2191904 A	(CORPORATE COMMUNICATIONS) see page 2, lines 82-92	5 at least
X	GB 2157529 A	(CORPORATE COMMUNICATIONS) see page 2 lines 109-117	5 at least

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